

REMARKS

Claims 1 and 4 are pending. Claims 2, 3, 5 and 6 are canceled. Claim 1 is amended to include the features of canceled claims 2 and 3. Claim 4 is amended to include the features of canceled claims 5 and 6. The features present in the claims as amended are present in the originally filed specification. No new matter is added.

The claims have been amended to more particularly point out and distinctly claim Applicant's invention.

Objections to the Specification

With respect to the Examiner's objection to the word "coiling" in the second full paragraph on page 12 of the specification, it is submitted that the objected to word is no longer present in the specification. Accordingly, it is respectfully requested that the objection be withdrawn.

The Invention

In the inspection of solder bumps, the use of a telecentric optical system alone does not provide successful determination of the bump height. This is particularly true with bumps which are formed by reflowing solder. This is due to the fact that brightness varies greatly between bumps depending on the oxidized condition of the bump surface and also depending on the bump shape.

This tendency is of increased significance with smaller bumps and causes serious problems when inspecting narrowly-pitched fine bumps as are used in recent semiconductor devices.

The present invention solves this problem by reflowing solder to impart the bumps with a substantially hemispherical shape and then coining the top portions of the bumps into a planar shape before inspection.

This feature of the present invention, which provides bumps with the top portions having a uniform brightness, enables the bump height to be successfully determined by using a telecentric optical system.

35 USC 103 Rejections

Claims 1 and 4 are rejected under 35 U.S.C. 103 on pages 2 through 4 of the Office Action as being unpatentable over U.S. Patent 6,133,052 to Ichihara in view of U.S. Patent 6,317,513 to Michael. Applicants hereby respectfully traverse the rejection of the claims. It is submitted that Ichihara only discloses the optical inspection of bumps. Accordingly, applicants argue that Ichihara does not recite that the bumps are formed into a substantially hemispherical shape by reflowing of solder and have top portions which are shaped into a planar shape by a coining process, and that said top portion of all of said bumps of said inspection object are on the same plane.

Accordingly, it is submitted that the Ichihara reference fails to disclose the above-mentioned features and that U.S. Patent 6,317,513 to Michael which the Examiner cited as a secondary reference in the proffered combination of references fails to provide any teaching,

suggestion or motivation to arrive at the present invention when combined with the Ichihara reference.

In the rejection in the Office Action, the Examiner admits that the primary reference of Ichihara fails to disclose illuminating an inspection object with a parallel pencil of light vertical to the top portions of the bumps through a telecentric optical system. Therefore, the Examiner cited the Michael reference as allegedly teaching what is not disclosed in the Ichihara reference. It is submitted that the Michael reference is directed to an altogether different method and apparatus which concerns solder paste which is screen printed on printed circuit boards using a stencil. In addition, applicants argue that the method set forth in Michael of acquiring a pre-image and a post-image is entirely different from that of the present claimed invention. Accordingly, it is respectfully submitted that the Michael reference does not provide any teaching, suggestion or motivation to provide the invention of Ichihara with a telecentric optical system and therefore, the two references cannot be combined.

In the event that the Examiner considers combining the Kyo reference, Japanese Abstract JP 10032279, with the Ichihara reference and the Michael reference to reject the presently amended claims 1 and 4, applicants provide the following remarks. Kyo is merely directed to a rectilinear gold tail 22 which is pressed with coining device 50 to form a curved gold tail 23 and a solder ball 28 is mounted on the curved gold tail 23. Moreover, Kyo does not apply the coining of a solder bump and does not relate to any bump inspection. Additionally, Kyo does not relate to any optical inspection and cannot be combined with the Ichihara reference or the Michael reference to reject the claims of the present invention.

Regarding the 35 U.S.C. 103(a) rejections of the claims in the Office Action, applicants hereby request reconsideration and withdrawal of the rejection.

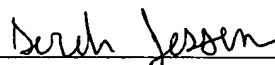
CONCLUSION

For the reasons set forth above, Applicants' present invention, as recited in the amended claims now more clearly and particularly, is patentable. Reconsideration and withdrawal of all outstanding rejections and objections in this case is hereby respectfully requested.

If further matters remain in connection with this case, the Examiner is invited to telephone the Applicant's undersigned representative to resolve them.

In the event that an additional fee is required with respect to this communication, the Commissioner is hereby authorized to charge any fees, or credit any overpayment, to Paul & Paul Deposit Account No. 16-0750.

Respectfully Submitted,



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